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# UNITED STATES DEPARTMENT OF AGRICULTURE,

## BUREAU OF ANIMAL INDUSTRY,

A. D. MELVIN, CHIEF OF BUREAU.

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### GLANDERS AND FARCY.<sup>1</sup>

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#### NATURE AND HISTORY.

Let it be understood at the outset that glanders and farcy are one and the same disease, differing only in that the first term is applied to the disease when the local lesions predominate in the internal organs, especially in the nostrils, lungs, and air tubes, and that the second term is applied to it when the principal manifestation is an outbreak of the lesions on the exterior or skin of the animal. The term glanders applies to the disease in both forms, while the term farcy is limited to the visible appearance of external trouble only; but in the latter case internal lesions always exist, although they may not be evident.

Glanders is a contagious constitutional disease of the genus *Equus* (the horse, ass, and mule), readily communicable to man, the dog, the cat, the rabbit, and the guinea pig. It is transmitted with difficulty to sheep and goats, and cattle seem to be entirely immune. It runs a variable course and usually produces the death of the animal affected with it. It is characterized by the formation of neoplasms, or nodules, of connective tissue, which degenerate into ulcers from which exudes a peculiar discharge. It is accompanied with a variable degree of fever, according to the rapidity of its course. It is subject to various complications of the lymphatic glands, of the lungs, of the testicles, of the internal organs, and of the subcutaneous connective tissue.

Glanders is one of the oldest diseases of which we have definite knowledge in the history of medicine.

Extensive outbreaks of glanders are described as prevailing in the great armies of continental Europe and England from time to time during the periods of all the wars of the last few centuries.

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<sup>1</sup> Reprinted (without illustrations and with slight condensation) from the Special Report on Diseases of the Horse, edition of 1916.



Glanders was imported into America at the close of the eighteenth century, and before the end of the first half of the nineteenth century had spread to a considerable degree among the horses of the Middle and immediately adjoining Southern States. This disease was unknown in Mexico until carried there during the Mexican War by the badly diseased horses of the United States Army. During the first half of the nineteenth century a large body of veterinarians and medical men protested against the contagious character of the disease, and by their opinion prevailed to such an extent against the common opinion that several of the Governments of Europe undertook a series of experiments to determine the right between the contesting parties.

At the veterinary school at Alfort and at the farm of Lamirault in France several hundred horses which had passed examination as sound had glandered horses placed among them under various conditions. The results of these experiments proved conclusively the contagious character of the disease.

In 1881 Bouchard, of the faculty of medicine in Paris, assisted by Capitan and Charrin, undertook a series of experiments with matter taken from the farcy ulcer of a human being. They afterwards continued their experiments with matter taken from horses, and in 1883 succeeded in showing that glanders is caused by a bacterium which is capable of propagation and reproduction of others of its own kind if placed in the proper media. In 1882 the specific germ of glanders was first discovered and described by Loeffler and Schuetz in Germany.

When we come to study the etiology of glanders, the difference of susceptibility on the part of different species of animals, or even on the part of individuals of the same species, and when we come to find proof of the slow incubation and latent character of the disease as it exists in certain individuals, we understand how, in a section of country containing a number of glandered animals, others can seem to contract and develop the disease without having apparently been exposed to contagion.

#### CAUSES.

The contagious nature of glanders, in no matter what form it appears, being to-day definitely demonstrated, we can recognize but one cause for all cases, and that is contagion by means of the specific virus of the disease. The causative organism is known as the *Bacillus mallei*.

In studying the writings of the older authors on glanders, and the works of those authors who contested the contagious nature of the disease, we find a large number of predisposing causes assigned as factors in the development of the malady.



While virus from a case of glanders if inoculated into an animal of the genus *Equus* will inevitably produce the disease, we find a vast difference in the contagious activity of different cases of glanders. We find a great variation in the manner and rapidity of the development of the disease in different individuals and that the contagion is much more liable to be carried to sound animals under certain circumstances than it is under others. Only certain species of animals are susceptible of contracting the disease, and while some of these contract it as a general constitutional malady, in others it develops as only a local sore.

In acute glanders the contagion is found in its most virulent form, as is shown by the inevitable infection of susceptible animals inoculated with the disease, while the discharge from chronic semi-latent glanders and farcy may at times be inoculated with a negative result; again, in acute glanders, as we have a free discharge, a much greater quantity of virus-containing matter is scattered in the neighborhood of an infected horse to serve as a contagion to others than is found in the small amount of discharge of the chronic cases.

The chances of contagion are much greater when sound horses, asses, or mules are placed in the immediate neighborhood of glandered horses, drink from the same bucket, stand in the next stall, work in the same wagon, or are fed from feed boxes or mangers which have been impregnated by the saliva and soiled by the discharge of sick animals. Transmission occurs by direct contact of the discharges of a glandered animal with the tissues of a sound one, either on the exterior, when swallowed mixed with feed into the digestive tract, or when dried and inhaled as dust.

The stable attendants serve as one of the most common carriers of the virus. Dried or fresh discharges are collected from the infected animals in cleaning, harnessing, feeding, and by means of the hands, the clothing, the teeth of the currycomb, the sponge, the bridle, and the halter, and are thus carried to other animals.

An animal affected with chronic glanders in a latent form is moved from one part of the stable to another or works hitched with one horse and then with another, and may be an active agent in the spreading of the disease without the cause being recognized.

Glanders is found frequently in the most insidious forms, and we recognize that it can exist without being apparent; that is, it may affect a horse for a long period without showing any symptoms that will allow even the most experienced veterinarian to make a diagnosis.

Public watering troughs, the feed boxes of boarding stables, and the tavern stables of market towns are among the most common recipients for the virus of glanders, which is most dangerous in its fresh state, but cases have been known to be caused by feeding animals



in the box or stall in which glandered animals have stood several months before. While the discharge from a case of chronic glanders is much less liable to contain many active bacilli than that from a case of acute glanders, the former, if it infects an animal, will produce the same disease as the latter. It may assume from the outset an acute or chronic form, according to the susceptibility of the animal infected, and this does not depend upon the character of the disease from which the virus was derived.

The animals of the genus *Equus*—the horse, the ass, and the mule—are those which are the most susceptible to glanders, but of these we find a much greater receptivity in the ass and mule than we do in the horse. In the ass and mule in almost all cases the period of incubation is short, and the disease develops in an acute form. We find that the kind of horse infected has an influence on the character of the disease; in full-blooded, fat horses of a sanguinary temperament the disease usually develops in an acute form, while in the lymphatic, cold-blooded, more common race of horses the disease usually assumes a chronic form. If the disease develops first in the chronic form in a horse in fair condition, starvation and overwork are liable to bring on an acute attack, but when the disease is inoculated into a debilitated and impoverished animal, it is apt to start in the latent form. Inoculation on the lips or the exterior of the animal is frequently followed by an acute attack, while infection by ingestion of the virus and inoculation by means of the digestive tract is often followed by the trouble in the chronic latent form.

In the dog the inoculation of glanders may develop a constitutional disease with all the symptoms which are found in the horse, but more frequently the germs grow only at the point of inoculation, the lesion remaining for some time as a local sore which may then heal, leaving a perfectly sound animal; but while the local sore is continuing to ulcerate, and specific virus exists in it, it may be the carrier of contagion to other animals. In man we find a greater receptivity to glanders than in the dog, and in many unfortunate cases the virus spreads from the point of inoculation to the entire system and destroys the wretched mortal by extensive ulcers of the face and hemorrhage, or by destruction of the lung tissue; in other cases, however, glanders may develop, as in the dog, in local form only, not infecting the constitution and terminating in recovery, while the specific ulcer by proper treatment is turned into a simple one. In the feline species glanders is more destructive than in the dog. The point of inoculation ulcerates rapidly and the entire system becomes infected.

While a student the writer saw a lion in the service of Prof. Trasbot, at Alfort, which had contracted the disease by eating glandered meat and died with the lung riddled with nodules. A litter of kittens lapped the blood from the lungs of a glandered horse on



which an autopsy was being made, and in four days almost their entire faces, including the nasal bones, were eaten away by rapid ulceration. Nodules were found in the lungs. A pack of wolves in the Philadelphia Zoological Garden died in 10 days after being fed with the meat of a glandered horse. The rabbit, guinea pig, and mouse are especially susceptible to the inoculation of glanders, and these animals are convenient witnesses and proofs of the existence of suspected cases of the glanders in other animals by the results of successful inoculations.

The primary lesion in any form is a local point in which occurs a rapid proliferation of the cell elements which make up the animal tissue with formation of new connective tissue, with a crowding together of the elements until their own pressure on one another cuts off the circulation and nutrition and death takes place in them in the form of ulceration or gangrene. Following this primary lesion we have an extension of infection by means of the spread of the bacilli into those tissues immediately surrounding the first infected spot, which are most suitable for the development of simple inflammatory phenomena or the specific virus. The primary symptoms are the result of specific reaction at the point of inoculation, but at a later time the virus is carried by means of the blood vessels and lymphatic vessels to other parts of the body and becomes lodged at different places and develops in them; again, when the disease has existed in the latent form in the lungs of the animal and the virus is awakened into action from any cause, we have it carried to various parts of the body and developing in the most susceptible regions or organs. The points of development are most frequently determined by the activity of the circulation and the effects of exterior irritants. For example, if a horse which has been so slightly affected with the virus of glanders that no symptoms are visible is exposed to cold, rain, or sleet, or by the rubbing of the harness on the body and the irritation of mud on the legs, the disease is liable to develop on the exterior in the form of farcy, while a full-blooded horse which is employed at speed and has its lungs and respiratory tract gorged with blood from the extreme use of these organs will develop glanders as the local manifestation of the disease in the respiratory tract.

The previous reference to the existence of glanders under the two forms more commonly differentiated as glanders and as farcy and our reference to the various conditions in which it may exist as acute, chronic, and latent show that the disease may assume several different phases. Without for a moment losing sight of the fact that all these varied conditions are identical in their origin and in their essence, for convenience of study we may divide glanders into three classes—chronic farcy, chronic glanders, and acute glanders with or without farcy.



## CHRONIC FARCY.

## SYMPTOMS.

In farcy the symptoms commence by formation of little nodes on the under surface of the skin, which rapidly infringe on the tissues of the skin itself. These nodes, which are known as farcy "buds" and farcy "buttons," are from the size of a bullet to the size of a walnut. They are hot, sensitive to the touch, at first elastic, and afterward soft; the tissue is destroyed, and infringing on the substance of the skin the disease produces an ulcer, which is known as a chancre. This ulcer is irregular in shape, with ragged edges which overhang the sore; it has a gray, dirty bottom, and the discharge is sometimes thin and sometimes purulent; in either case it is mixed with a viscous, sticky, yellowish material like the white of an egg in consistency and like olive oil in appearance. The discharge is almost diagnostic; it resembles somewhat the discharge which we have in greasy heels and in certain attacks of lymphangitis, but to the expert the specific discharge is characteristic. The discharge accumulates on the hair surrounding the ulcer and over its surface and dries, forming scabs which become thicker by successive deposits on the under surface until they fall off, to be replaced by others of the same kind; and the excess of discharge may drop on the hairs below and form similar brownish yellow crusts. The farcy ulcers may retain their specific form for a considerable time—days or even weeks—but eventually the discharge becomes purulent in character and assumes the appearance of healthy matter. The surface of the gangrenous bottom of the ulcer is replaced by rosy granulations, the ragged edges are beveled off, and the chancre is turned into a simple ulcer which rapidly heals.

The farcy buttons occur most frequently on the sides of the lips, the sides of the neck, the lower part of the shoulders, the inside of the thighs, or the outside of the legs, but may occur on any part of the body.

We have next an irritation of the lymphatic vessels in the neighborhood of the chancre. Those become swollen and then indurated and appear like great ridges underneath the skin; they are hot to the touch and sensitive. The cords may remain for a considerable time and then gradually disappear, or they may ulcerate like a farcy bud itself, forming elongated, irregular, serpentine ulcers with a characteristic dirty, gray bottom and ragged edges, and pour out a viscous, oily discharge like the chancres themselves.

The essential symptoms of farcy are, as above described, the button, the chancre, the cord, and the discharge. We have in addition to these symptoms a certain number of accessory symptoms which, while not diagnostic in themselves, are of great service in



aiding the diagnosis in cases where the eruption takes place in small quantities and when the ulcers are not characteristic.

Epistaxis, or bleeding from the nose, without previous work or other apparent cause, is one of the frequent concomitant symptoms in glanders, and such hemorrhage from the nostrils should always be regarded with suspicion. The animal with farcy frequently develops a cough, much resembling that which we find in heaves—a short, dry, aborted, hacking cough, with little or no discharge from the nostrils. With this we find an irregular movement of the flanks, and on auscultation of the lungs we find sibilant or at times a few mucous râles. Another common symptom is a sudden swelling of one of the hind legs; it is found suddenly swollen in the region of the cannon, the enlargement extending below to the pastern and above as high as the stifle. This swelling is hot and painful to the touch and renders the animal stiff and lame. On pressure with the finger the swelling can be indented, but the pits so formed soon fill again on removal of the pressure. In severe cases we may have ulceration of the skin, and serum pours out from the surface, resembling the oozing which we have after a blister or in a case of grease. This swelling is not to be confounded with the stocking in lymphatic horses or the edema which we have in chronic heart or kidney trouble, as in the last the swelling is cool, not painful, and the pitting on pressure remains for some time after the pressure is withdrawn. It is not to be confounded with greasy heels. In these the disease commences in the neighborhood of the pastern and gradually extends up the leg, rarely passing beyond the neighborhood of the hock. The swollen leg in glanders almost invariably swells for the entire length in a single night or within a very short period. When greasy heels are complicated by lymphangitis, we have a condition very much resembling that of farcy. The swelled leg in farcy is frequently followed by an outbreak of farcy buttons and ulcers over its surface. In the entire horse the testicles are frequently swollen and hot and sensitive to the touch, but they have no tendency to suppuration. The acute inflammation is rapidly followed by the specific induration, which corresponds to the local lesions in other parts of the body.

Chronic farcy in the ass and mule is an excessively rare condition, but it sometimes occurs.

## CHRONIC GLANDERS.

### SYMPTOMS.

In chronic glanders we find the same train of inflammatory phenomena, varying in appearance from those of chronic farcy only by the difference of the tissues in which they are situated. In chronic glanders there is first the nodule, from the size of a shot to that of



a small pea, which forms in the mucous membranes of the respiratory tract. This may be just inside the wings of the nostrils or on the septum which divides the one nasal cavity from the other and may be easily detected, or it may be higher in the nasal cavities on the turbinated bones, or it may form in the larynx itself or on the surface of the trachea or deep in the lungs.

The nodules, which are first red and hard and consist of new connective tissue, soon soften and become yellow; the yellow spots break and we have a small ulcer the size of the preceding nodule, which has a gray, dirty bottom and ragged edges and is known as a chancre. This ulcer pours from its surface a viscous, oily discharge similar to that which we have seen in the farcy ulcer. The irritation of the discharge may ulcerate the lining mucous membrane of the nose, causing serpentine gutters with bottoms resembling those of the chancres themselves. If the nodules have formed in large numbers we may have them causing an acute inflammation of the Schneiderian membrane, with a catarrhal discharge which may mark the specific discharge, or that which comes from the ulcers, and resembles the discharge of strangles or simple inflammatory diseases.

The eruption of the ulcers and discharge soon cause an irritation of the neighboring lymphatics; and in the intermaxillary space, deep inside of the jaws, we find an enlargement of the glands, which for the first few days may seem soft and edematous, but which rapidly becomes confined to the glands, these being from the size of an almond to that of a small bunch of berries, exceedingly hard and nodulated. This enlargement of the glands is found high on the inside of the jaws, firmly adherent to the base of the tongue. It is not to be confounded with the puffy, edematous swelling, which is not separated from the skin and subcutaneous connective tissues found in strangles, in laryngitis, and in other simple inflammatory troubles.

These glands bear a great resemblance to the indurated glands which we find in connection with the collection of pus in the sinuses; but in the latter disease the glands have not the extreme nodulated feel which they have in glanders. With the glands we find indurated cords, feeling like balls of tangled wire or twine, fastening the glands together.

The essential symptoms of glanders are the nodule, the chancre, the glands, and the discharge. With the development of the nodules in the respiratory tract, according to their number and the amount of eruption which they cause, we may find a cough which resembles that of a coryza, a laryngitis, a bronchitis, or a broncho-pneumonia, according to the location of the lesions. In chronic glanders we find the same accessory symptoms that occur in chronic farcy, the hemor-



rhage of the nose, the swelling of the legs, the chronic cough, and, in the entire horse, the swelling of the testicles.

On healing, the chancres on the mucous membranes leave small, whitish, star-shaped scars, hard and indurated to the touch, which remain for almost an indefinite time. The chancres heal and the other local symptoms disappear with the exception of the enlargement of the glands, and we find these so diminished in size that they are scarcely perceptible on examination. During the subacute attacks, with a minimum quantity of local troubles, in chronic glanders and in chronic farcy, the animal rarely shows any degree of fever but does have a generally dejected appearance; it loses flesh and becomes hidebound, the skin becomes dry, and the hairs stand on end. There is a cachexia, however, which resembles greatly that of any chronic organic trouble but is not diagnostic, although it has in it certain appearances and conditions which often render the animal suspicious to the eye of the expert veterinarian, while without the presence of local lesions he would be unable to state on what he has based his opinion.

### ACUTE GLANDERS.

#### SYMPTOMS.

In the acute form of glanders we find the symptoms which we have just studied in chronic farcy and in chronic glanders in a more acute and aggravated form. There is a rapid outbreak of nodules in the respiratory tract which rapidly degenerate into chancres and pour out a considerable discharge from the nostrils. There is a cough of more or less severity, according to the amount and site of the local eruption. Over the surface of the body swellings occur which are rapidly followed by farcy buttons, which break into ulcers; we find the indurated cords and enlargement of the lymphatics.

Bleeding from the nose, sudden swelling of one of the hind legs, and the swelling of the testicles are liable to precede an acute eruption of glanders. As the symptoms become more marked the animal has difficulty of respiration, the flanks heave, the respiration becomes rapid, the pulse becomes quickened, and the temperature becomes elevated to 103°, 104°, or 105° F.

With the other symptoms of an acute fever the general appearance and station of the animal is that of one suffering from an acute pneumonia, but upon examination, while we may find sibilant and mucous râles over the side of the chest and may possibly hear tubular murmurs at the base of the neck over the trachea, we fail to find the tubular murmur or the large area of dullness on percussion over the sides of the chest which belong to simple pneumonia.



## DIAGNOSIS.

When there is doubt as to the diagnosis, the mallein test, the inoculation test, or the complement-fixation test may be employed. The mallein test is made by injecting mallein (a sterilized extract from a culture of glanders bacilli) beneath the skin. If the horse has glanders there results a febrile reaction and a swelling at the point of injection. If the horse does not have glanders the mallein has no effect, or, at most, it produces a slight swelling only at the point of injection. The inoculation test consists in the inoculation of a susceptible animal (usually a guinea pig) with some of the suspected discharge from the nose or a farcy ulcer. If the material is properly used and if it contains bacilli of glanders the experimental animal will develop the disease.

The eye test is now universally accepted as a very satisfactory means of diagnosing glanders. This consists in dropping into an eye of a suspected animal a specially prepared solution of mallein, as a result of which in an infected animal the inflammation develops in the eye, resulting in a discharge which varies in intensity from a mucopurulent character to a thick, sticky pus. The eyelids may also swell and many times become glued together. The reaction usually appears in from 8 to 20 hours after the introduction of the mallein.

Neither of these tests should be put into use except by a competent veterinarian. The complement-fixation test is a highly specialized laboratory test and can be carried out only by one versed in laboratory technique. (See Bureau of Animal Industry Bulletin 136.)

The post-mortem examination of the lungs shows that the pneumonia of glanders is a lobular, V-shaped pneumonia scattered throughout the lungs and caused by the specific inflammatory process taking place at the divergence of the smaller air tubes of the lungs. In some cases of acute glanders the formation of nodules may so irritate the mucous membrane of the respiratory tract and cause such a profuse discharge of mucopurulent or purulent matter that the specific character of the original discharge is entirely masked. In this case, too, for a few days the submaxillary space may so swell as to resemble the edematous, inflamed glands of strangles, equine variola, or laryngitis. This condition is especially liable to be marked in an acute outbreak of glanders in a drove of mules.

Cases of chronic farcy and glanders, if not destroyed, may live in a diseased condition until the animal dies from general emaciation and anemia, but in the majority of cases, from some sudden exposure to cold, it develops an acute pneumonia or other simple inflammatory trouble which starts the latent disease, and the animal has acute glanders.

In the ass, mule, and plethoric horses acute glanders usually terminates by lobular pneumonia. In other cases the general symptoms



may subside. The symptoms of pneumonia gradually disappear, the temperature lowers, the pulse becomes slower, the ulcers heal, leaving small, indurated cicatrices, and the animal may return to apparent health, or may at least be able to do a small amount of work with but a few symptoms of the disease remaining in a chronic form. During the attack of acute glanders the inflammation of the nasal cavities frequently spreads into the sinuses, or air cells, which are found in the forehead and in front of the eyes on either side of the face, and causes abscesses in these cavities which may remain as the only visible symptom of the disease. An animal which has recovered from a case of acute glanders, like the animals which are affected by chronic glanders and chronic farcy, is liable to be affected with emphysema of the lungs (heaves) and to have a chronic cough. In this condition it may continue for a long period, serving as a dangerous source of contagion, the more so because the slight quantity of discharge does not serve as a warning to the owner or driver as profuse discharge does in the more acute cases.

At the post-mortem examination of an animal which has been destroyed or has died of glanders we find evidences of the various lesions which we have studied in the symptoms. In addition to this, we find nodules similar to those which we have seen on the exterior throughout the various organs of the body. Nodules may be found in the liver, in the spleen, and in the kidneys. We may find inflammation of the periosteum of the bones, and we have excessive alterations in the marrow in the interior of the bones themselves. Both these conditions during the life of the animal may have been the cause of the lamenesses which were difficult to diagnose.

In one case which came under the observation of the writer a lame horse was destroyed and found to have a large abscess of the bone of the arm, with old nodules of the lungs. When an animal has died immediately after an attack of a primary acute case of glanders, we find small V-shaped spots of acute pneumonia in the lungs. If the animal has made an apparent recovery from acute glanders, and in cases of chronic farcy and chronic glanders, no matter how few the external and visible symptoms may have been, there is a deposit of nodules—small, hard, indurated nodes—of new connective tissue to be found in the lungs. When these have existed for some time we may find a deposit of lime salts in them. These indurated nodules retain the virus and their power to give out contagion for an almost indefinite time and predispose to the causes which we have studied as the common factors in developing a chronic case into an acute case; that is, an inflammatory process weakens their vitality and produces a reinfection of the entire animal. The blood of an animal suffering from chronic glanders and farcy is not virulent and is unaltered, but during the attack of acute glanders, while the animal has fever, the blood becomes virulent and remains so for a few days.



## TREATMENT.

Almost the entire list of drugs in the pharmacopœia has been tested in the treatment of glanders. Good hygienic surroundings, good feed, with alteratives and tonics frequently ameliorate the symptoms, and often do so to such an extent that the animal would pass the examination of any expert as a perfectly sound animal. While in this case the number of nodules of the lungs, which are invariably there, may be so few as not to cause sufficient disturbance in the respiration as to attract the attention of the examiner, yet they exist and will remain there almost indefinitely, with the constant possibility of a return of acute symptoms.

It is probable that some horses may recover from glanders if the infection is slight, but it will not do to depend upon this except under the most stringent veterinary supervision. With good care, good feed, good surroundings, and little work an animal affected with glanders may live for months or even years in a state of apparently perfect health; but with the first deprivation of feed, with a few days of severe hard work, with exposure to cold, or with the attack of a simple fever or inflammatory trouble from other causes, the latent seeds of the disease break out and develop the trouble again in an acute form.

In several celebrated cases horses which have been affected with glanders have been known to work for years and die from other causes without ever having had the return of symptoms; but allowing that these cases may occur, they are so few and far between and the danger of infection of glanders to other horses and to the stable attendants is so great that no animal which has once been affected with the disease should be allowed to live unless repeated mallein tests have shown him to become free from taint of glanders.

In all civilized countries, with the exception of the States in the United States, the laws are most stringent regarding the prompt declaration on the part of the owner and attending veterinarian at the first suspicion of a case of glanders, and they allow indemnity for the animal. When this is done, in all cases the animal is destroyed and the articles with which it has been in contact are thoroughly disinfected. When the attendants have attempted to hide the presence of the disease in a community, punishment is meted out to the owner, attending veterinarian, or other responsible parties. Several States have passed excellent laws in regard to glanders, but these laws are not always carried out with the rigidity with which they should be.